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Bulletin No. 36

April 27, 1922.

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M. M. LEIGHTON
COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF INTERNAL AFFAIRS
James F. Woodward, Secretary

BUREAU OF TOPOGRAPHIC AND GEOLOGICAL SURVEY
George H. Ashley, State Geologist

COAL BEDS IN INDIANA COUNTY, PENNSYLVANIA

By

J. D. Sisler.

Introduction.

Indiana County for many years has been one of the most important bituminous coal producing counties in Pennsylvania. The greater part of the coal is mined from the Upper Freeport bed, which is the largest reserve of valuable and easily accessible coal in the county. The Lower Kittanning, Lower Freeport, and the Pittsburgh beds are important locally as sources of shipping coal. Many other beds have future value, but are not mined at present.

The thick coal beds of the Allegheny formation, including the Kittannings and Freeports, are large reserves for future use. Practically all mining as yet is by drifts, although there are extensive areas where these beds are within easy shafting distance. The Pittsburgh bed, restricted to a small area in the southwestern part of the county, will be exhausted within a few years.

In 1918 Indiana County stood sixth in Pennsylvania as a bituminous coal producer. In that year, 12,743,190 tons were produced, valued at \$37,576,089. Of this amount, 12,209,067 tons, valued at \$36,153,156 were loaded at the mines for shipment; 110,848 tons were sold to local trade and used by employees; and 189,056 tons were used at the mines for steam and heat; 234,219 tons, valued at \$646,828 were made into coke at the mines.

Indiana County is bounded on the north by Jefferson County, on the east by Clearfield and Cambria counties, on the south by Westmoreland County, and on the west by Armstrong County. Its greatest width from north to south is 37.5 miles, and from east to west 28.5 miles. Its area is 847.2 square miles. The population in 1920 was 80,910.

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Transportation facilities are ample. The Pennsylvania Railroad follows Conemaugh River along the entire southern boundary of the county. A branch line runs north from Blairsville to Indiana and east from Black Lick into Cambria County. The New York Central and Pennsylvania Railroads serve the numerous mines between Cherry Tree, Clymer, and Heilwood, and also the Glen Campbell field in the northeastern part of the county. The Buffalo, Rochester and Pittsburgh Railroad enters the county at Blaisdell Junction, serves the Rossiter field, runs southwest through Juneau, Savan, Marion Center, Home, Creekside, Shelocta and Parkwood, and terminates at Iselin. A branch line serves the Jacksonville and Kent area; and another runs south from Creekside, through Indiana to Black Lick. This railroad uses the Pennsylvania tracks on Black Lick Creek between Black Lick and Vintondale. The main line of the Buffalo, Rochester and Pittsburgh Railroad crosses the northwestern part of the county along Mahoning Creek. The New York Central has a branch line to Rossiter. The Buffalo and Susquehanna Railroad runs southwest from Juneau, and terminates at Sagamore.

Indiana County has many miles of good roads, most of which are dirt. They are used extensively for transportation of coal for local use. During times of excessive prices they are also used for hauling coal to sidings.

Chestnut Ridge is the most pronounced topographic feature of Indiana County. It is a narrow highland belt, the distance from valley to valley on either side being only about five miles. The ridge is less prominent than farther south; its dissected crest is composed of knobs ranging from 1700 to 1900 feet in elevation. West of Chestnut Ridge the topography is less rugged, or gently undulating, and is marked by low, rounded hills. The county is in the Appalachian plateau. The greater part of this upland region is characterized by softly rounded outlines and gentle slopes. The level areas are few and small.

STRUCTURE.

There are fifteen structure features in the county, each having a general northeast-southwest trend. The Chestnut Ridge anticline is the most pronounced of these. Most of the others are minor.

The steep western slope of Laurel Hill anticline, which brings the Catskill formation to outcrop, crosses the extreme southeastern tip of the county.

Barnesboro syncline, lying northwest of Laurel Hill anticline, crosses Conemaugh River near New Florence, passes through Wehrum, and leaves the county one-half mile south of Nipon, Cambria County. It is a broad shallow basin, with the rocks rising gently northwest to the Nolo anticline.

Nolo anticline enters Indiana County near New Florence, extends northeast near Croft, Strongstown and Pineton, and leaves the county two miles west of Barnesboro, Cambria County. It is a rather sharp fold, having local dips of five degrees. The dips are greater on the western slope. The axis rises gently to Pineton, and runs

nearly level from that point to the eastern edge of the county.

Brush Valley syncline, the next structure to the northwest, has its southern end in Indiana County, between Nolo and Chestnut Ridge anticlines. It extends northeast near Brush Valley and Cookport, leaving the county about two miles north of Cherry Tree. It is a broad fold, with rather steep dips on both flanks. The axis is extremely irregular in elevation.

Chestnut Ridge anticline, the largest fold in the county, crosses Conemaugh River about 2 miles west of Bolivar, and extends northeast near Penn Run (Greenville), Utah (Taylorville), and Hortens, leaving the county near the northeast corner. The west slope of the anticline is generally steepest; the fold is highest between Black Lick Creek and Conemaugh River. The northern part of the fold in Indiana County is broad and flat, and the axis is extremely variable in elevation.

Latrobe syncline enters the county at Blairsville, extends northeast near Homer City, and flattens out at Indiana. It is a well marked structure, with the rocks rising rapidly on the eastern flank, and gently on the western. The axis is very regular in elevation.

Dixonville syncline is a minor structure lying between Chestnut Ridge anticline and Richmond anticline near Dixonville. The basin is narrow and flat. The greatest rise of the rocks is on the eastern flank.

Richmond anticline is a short structure lying near Kintersburg and Rayne. The dips on both flanks are gentle. The axis rises sharply to the north.

Jacksonville anticline crosses the Conemaugh near Saltsburg, and extends northeast to Curry Run where it flattens out. It is a well defined structure with a broad flat top, and gentle dips on both flanks.

McKee Run anticline is a low gentle fold lying between Indiana and Creekside. This anticline is important because of the occurrence of gas along its northwest flank in the vicinity of Creekside.

Elders Ridge syncline enters the county at Edri, extends northeast near Elders Ridge, West Lebanon and Chambersville, and flattens out in the northern part of the county. It is a canoe shaped basin, shallow at both ends but deepening toward the middle at Iselin. The slopes on both flanks are rather steep but remarkably uniform.

Dutch Run anticline is a minor fold of small extent, lying just west of Willett.

Punxsutawney syncline, Perrysville and Roaring Run anticlines lie in the northwestern corner of the county, but their exact locations have not been determined by the Geological Survey. They are minor structures.

STRATIGRAPHY.

The outcropping rocks of Indiana County belong to the Quaternary and Carboniferous systems. The Quaternary system is represented by river deposits of recent age; the Carboniferous by the Monongahela, Conemaugh, Allegheny, Pottsville, Mauch Chunk and Pocono formations.

The flood plains of the streams are deposits of alluvium - gravel, sand and silt - particles of disintegrated rock which have been washed down from the hillsides and deposited in their present positions in times of high water.

The Monongahela formation is present only in the highlands on the southwestern border of the county. The upper part has been eroded, leaving about 220 feet of rocks intact above the Pittsburgh coal, consisting chiefly of sandstone and calcareous shale, but including two limestones and two workable coal beds.

The Conemaugh formation is about 650 feet thick, and consists of shales of various colors, interstratified with beds of coarse sandstone, a few thin limestones, and several coal beds, some of which have considerable economic importance.

The Allegheny formation is about 295 feet thick and is composed of massive sandstone and several beds of limestone and fireclay. It contains many coal beds, four of which are locally valuable. This formation underlies practically all the county.

The Pottsville formation is about 100 feet thick, and is composed of two beds of sandstone, separated by shale which in some places carries one or more unimportant coal beds. Its outcrop is limited.

The Mauch Chunk formation is composed entirely of shale with thin lenses of sandstone interbedded in it. Its outcrop is limited to a few valleys where streams have cut across anticlines.

The Pocono formation is composed of greyish-green sandy shale and sandstones, with several bands of red shale, and has a thickness of about 1050 feet. It is not coal bearing.

COAL BEDS.

The following table shows the stratigraphic relation of the beds and their range in thickness.

Coal Beds in Indiana County.

| | Name of bed | Average interval | Range in thickness of coal beds |
|------------------|-------------------------------------|------------------|---------------------------------|
| Monongahela | (Sewickley - - - - - | - - - - - | 6" - 5'0" |
| | (| 80 | |
| | (Redstone - - - - - | - - - - - | 6" - 3'0" |
| | (| 45 | |
| Conemaugh 650 | (Pittsburgh - - - - - | - - - - - | 6' - 10'0" |
| | (| 400-425 | |
| | (Coal - - - - - | - - - - - | 0 - 2'0" |
| | (| 70-100 | |
| | (Coal - - - - - | - - - - - | 0 - 1'8" |
| | (| 40-60 | |
| | (Coal - - - - - | - - - - - | 0 - 2'0" |
| | (| 50-75 | |
| | (Upper Freeport ("E") - - - - - | - - - - - | 1" - 7'0" |
| Allegheny 295 | (| 25-80 | |
| | (Lower Freeport ("D") - - - - - | - - - - - | 6" - 16" |
| | (| 40-80 | |
| | (Upper Kittanning ("C'") - - - - - | - - - - - | 6" - 5'0" |
| | (| 30-80 | |
| | (Middle Kittanning ("C") - - - - - | - - - - - | 0 - 2'0" |
| | (| 35-70 | |
| | (Lower Kittanning ("B") - - - - - | - - - - - | 0 - 5'0" |
| | (| 50-85 | |
| | (Clarion ("A'") - - - - - | - - - - - | 0 - 1'0" |
| | (| 20-55 | |
| | (Brookville ("A") - - - - - | - - - - - | 0 - 4'0" |

The coals in the Mercer group in the Pottsville are not mineable in Indiana County. On Black Lick Creek, a coal in the Pottsville formation is locally 14 inches thick, but appears to be very lenticular.

Coal Beds in Allegheny Formation.

Brookville ("A") coal. This bed, lying a few feet above the Pottsville sandstone, is generally very impure, high in sulphur, and varies greatly in thickness. At Old Conemaugh Furnace it is 4 feet thick, and at Bolivar, ten miles down the Conemaugh only 18 inches. On Black Lick Creek at Heshbon and Bells Mills it is between 3 and 4 feet thick, and has been used for steaming purposes and for burning

brick. It is extremely high in ash and sulphur. In Pine township it ranges from 2 feet 2 inches to 3 feet 10 inches thick.

Clarion ("A") coal. This coal, lying 20 to 55 feet above the Brookville, is thin, but very persistent in the county. It averages 6 inches thick.

Lower Kittanning ("B") coal. This bed is about 100 feet above the Pottsville sandstone, and 150 feet below the Upper Freeport coal. It is below drainage practically everywhere in the county, and few openings have been made in it. The bed does not average more than 2 feet in the entire county, although in local areas it has a maximum thickness of 5 feet. It generally has 3 to 4 inches of bony coal at the top. Its floor is fireclay and is persistently rolly. The shale roof is always regular. There are no persistent partings or binders, although locally there is a thick clay parting near the center of the bed. Local lenses of pyrite are common.

The Lower Kittanning is important on Conemaugh River and on Flack Lick Creek. It averages 2 feet 10 inches thick at Boltz, and locally thickens to 3 feet 2 inches, and has 5 inches of bone on top. It is 3 feet 2 inches thick in Robindale shaft, where it is mined for use in the West Penn power plant; 4 inches of top coal are locally bony. The bed is 5 feet 3 inches thick at Lockport, including a 3 inch parting of bone and shale 18 inches from the bottom, and 6 inches of bone coal at the top. It is very high in sulphur, made so by numerous lenses of pyrite. The Lower Kittanning coal is mined extensively at Robinson (Bolivar), where it varies from 3 feet 6 inches to 5 feet thick. It carries a few inches of bone coal on top. A local binder from 1 to 6 inches thick is sometimes present 18 inches above the bottom. The coal is locally very clean, but tends to be rather high in sulphur. The Lower Kittanning coal is mined extensively on Black Lick Creek east of Josephine, where it is 3 feet 4 inches thick, and has 4 inches of bone coal on the top. The coal ranges from 2 feet 4 inches to 4 feet thick at Heshbon. The bottom is very rolly, and there is 2 inches of bone coal at the top of the bed. The bed is 3 feet 10 inches thick at Scott Glenn, but contains many lenses of pyrite.

The Lower Kittanning is deeply buried in most of the southwestern part of the county. It outcrops at a few points on Crooked Creek where it averages 2 feet 6 inches thick, but it is extremely high in sulphur. The coal is 3 feet 6 inches thick where mined in Center township, and has 3 to 4 inches of bone coal on the top. It is locally 3 feet 10 inches thick in Armstrong township. There are many old openings in this bed southeast of Indiana, where the coal is used for domestic purposes. On Furriers Run the coal is 3 feet thick; on Yellow Creek, 3 feet 6 inches. One mile above Ramsey Run on Two Lick Creek the bed is 6 feet 2 inches thick, including a 16 inch shale parting 14 inches from the bottom. Just above Allen Run on Two Lick Creek the bed is 7 feet 2 inches thick, including a 12 inch shale parting 2 feet 6 inches from the bottom. There are several openings in the Lower Kittanning coal on Penn Run and its tributaries. At Greenville it is 3 feet 10 inches thick; at Atherson's on the North Fork of Penn Run, $1\frac{1}{2}$ miles due north of Greenville, the coal ranges

from 3 feet 10 inches to 4 feet 3 inches thick. The coal is mined extensively at Clymer, where it averages 3 feet 3 inches thick, not including a few inches of bone coal at the top. Drilling in the eastern part of the county, where the Lower Kittanning coal is deep under cover, indicates that it is locally thin, but mineable in large areas.

The Lower Kittanning coal is exposed in the northeastern part of the county only in the Glen Campbell region, but is not an important bed at present. It is 3 feet 4 inches thick at Hillsdale; 2 feet 10 inches thick near Arcadia. It varies from 2 feet 8 inches to 4 feet 2 inches thick at Glen Campbell. Locally it has a $\frac{1}{2}$ inch bone parting near the bottom, and also locally a few inches of bone coal at the bottom. At Juneau the coal is 19 inches thick and clean; at Enterprise, 12 inches thick; at Richmond, 3 feet 8 inches thick, including a $1\frac{1}{2}$ inch shale parting near the middle of the bed. The coal ranges from 18 inches to 3 feet thick near the headwaters of Mahoning Creek, and is clean but for numerous "knife blades" of pyrite.

The Lower Kittanning is deep under cover in most of the northwestern part of the county. Drill hole records indicate that it is locally 4 feet thick, although the average is less than 3 feet. The bed has a persistent bony top, and carries large amounts of pyrite.

Middle Kittanning ("C") coal. This bed, lying 35 to 70 feet above the Lower Kittanning coal, is thin and unimportant in the county, but has been opened for house coal in a few places. Its maximum thickness is 2 feet, and its average is about 6 inches. It measures 18 inches on Black Lick Creek; 16 inches on Two Lick Creek; and locally 2 feet thick on Mahoning Creek.

Upper Kittanning ("C") coal. This bed, lying about 100 feet above the Lower Kittanning coal, is thin and unimportant in this county. There are places near Deckers where it is 5 feet thick and in some spots it is overlain by 4 feet of cannel coal. South of Richmond a 5 foot bed of clean coal is probably at the horizon of the Upper Kittanning. It is locally 4 feet thick on Black Lick Creek. It is extremely variable in thickness and is very bony and high in sulphur.

Lower Freeport ("D", Moshannon) coal. The Lower Freeport lies from 40 to 80 feet above the Upper Kittanning coal in Indiana County. The coal ranges from 12 inches to 16 feet thick, and varies from a clean coal of excellent quality to a coal high in sulphur and ash.

The Lower Freeport is thin and irregular in all the townships south of Indiana, averaging less than 2 feet thick; furthermore it is high in sulphur. In local areas between Black Lick and Homer City the bed is 3 feet thick, including a two inch bone parting 4 inches from the bottom. On Neal Run, near Jacksonville, the maximum thickness of the coal is 5 feet 2 inches. On the divide between Dixon and Buck Runs, one mile north of Two Lick Creek, the coal is 4 feet 4 inches thick. South of Dixonville it ranges from 3 feet 6 inches to 4 feet; one-half mile north of Dixonville it is 4 feet 3 inches thick. The

coal is excellent, although locally there are many small bands of pyrite scattered through it. The bed ranges from a few inches to 4 feet 9 inches thick in Armstrong township.

The only development of the Lower Freeport in the district east of Indiana is at Heilwood, where the bed has a maximum thickness of 3 feet 6 inches. The coal is clean, low in sulphur and ash, and mines out in large lumps. In Grant township, between Richmond and Mahoning Creek, the bed averages 2 feet 6 inches thick in a small area. Locally it has 5 inches of bone coal at the bottom, and a 1 inch bone binder 10 inches from the bottom.

An unusual thickness - 16 feet - together with exceptionally good quality is found in Montgomery and Banks townships, in the Glen Campbell district. However it diminishes rapidly to 2 feet or less. Where thickest the bed is divided into several benches by rather thick partings. The main bench, 6 feet thick, is separated from a lower bench 2 feet to 2 feet 6 inches thick, by a 5 inch clay parting. Over the main bench is a parting of light-drab clay and shale nearly 3 feet thick, containing a 7 inch band of coal near the middle. Above the thick parting is a local bench of coal 4 feet thick. In a few places the coal is a solid bed 4 to 5 feet thick. Generally it ranges from 3 feet to 3 feet 6 inches thick, with benches of bony coal about 8 inches thick, either above or below the main bench.

At Juneau, on Canoe Creek, the coal has a local maximum thickness of 3 feet 8 inches, but the average thickness is less than 2 feet. The coal is thin and irregular in the northwestern townships. It has a maximum thickness of 3 feet in very small areas on the north bank of Plum Creek. On Mahoning Creek in North Mahoning township the Lower Freeport coal is locally 5 feet thick, and has only one thin parting near the bottom. The coal is rather high in sulphur, but mines out in good sized lumps.

The Lower Freeport coal averages about 27 per cent volatile matter; 59 per cent fixed carbon; 9 per cent ash; and 1.5 per cent sulphur. In general it is a hard, compact coal that mines out in good sized lumps. Its extreme irregularity in thickness has greatly hindered its development, and will continue to do so until the more valuable Upper Freeport coal has been exhausted.

Upper Freeport ("E") coal. This bed, lying about 50 feet above the Lower Freeport and about 190 feet above the Lower Kittanning, is the most important coal in the county. Its thickness is variable but it is exceptionally regular in large areas. The bed averages 3 feet 3 inches thick in the entire county, and only locally has any partings and binders. It invariably has a regular fire clay bottom. The roof, where sandstone, is "rolly."

The Upper Freeport has been mined extensively on Conemaugh River in Indiana County. It averages less than 2 feet thick at Cramer, but at Seward it is 3 feet thick. There are many small mines at Lockport where it is very irregular, ranging from 3 feet to 6 feet 6 inches thick. A top bench of coal 24 to 28 inches thick carries much pyrite and is separated from the middle bench by 8 to 12 inches of bony coal.

The middle bench is excellent coal, 20 to 22 inches thick. A shale parting $\frac{1}{2}$ to $1\frac{1}{2}$ inches thick separates it from a lower bench 20 inches to 2 feet 2 inches thick. The coal in the lower bench is high in ash, but has been used with much success for steaming purposes.

At Robinson and Condit, the coal is 6 to 7 feet thick including a persistent bony top 10 to 12 inches thick, and two bone partings, one averaging 4 inches and the other 6 inches. On Black Lick Creek the Upper Freeport coal averages less than 12 inches thick and where 3 feet thick it is very bony and extremely high in sulphur. In the western townships it averages 4 feet thick. Openings have been made in the vicinity of Jacksonville, where the coal ranges from 3 feet 6 inches to 4 feet 7 inches thick. It is high in ash and sulphur. In Conemaugh township the coal is 3 feet 11 inches thick, with 3 inches of bony coal and shale 6 inches above the bottom. The Upper Freeport is 5 feet thick on Crooked Creek and its tributaries, including a 6 inch shale parting 18 inches from the top. In Armstrong township the Upper Freeport ranges from 2 to 3 feet thick. New operations are starting in this bed at Shelocta. The coal thins northward and is 2 feet 10 inches to 3 feet 6 inches thick on South Branch of Plum Creek, and is parted by 1 inch of shale 5 inches from the bottom.

The bed is very important in the northwestern townships. The coal locally averages 6 feet on North Fork of Plum Creek. It carries numerous pyrite lenses, and is parted by 1 inch of shale near the bottom and 5 inches of bone coal near the top. The bed is 4 feet thick on Mahoning Creek in Indiana County, and has 8 inches of bone coal at the top, a $\frac{1}{2}$ to 2 inch bone binder 8 to 10 inches above the bottom, and numerous streaks of pyrite.

The Upper Freeport coal is also very important in the central tier of townships. It is mined extensively on Two Lick Creek. At Gracetown it is 6 feet 8 inches thick, including an 8 inch shale parting 2 feet 6 inches from the top. The upper bench carries considerable pyrite, and the lower bench is used after washing, for making coke. The coke is bright, hard and has well developed cell structure. On Bearin Run the bed is 6 feet thick, including an 8 inch shale parting 19 inches from the top. A number of openings have been made on the Upper Freeport coal on Chestnut Ridge, and measurements show that in this region there is little variation in the thickness of the coal. On the road between Homer and Heshbon, $1\frac{1}{4}$ miles east of Gracetown the coal is 5 feet thick, including 9 inches of shale and bone, 6 to 8 inches from the top. Southeast of Indiana on Two Lick Creek the coal is 7 feet 3 inches thick, including 10 inches of shale 27 inches from the top. This thickness is persistent in most of White township.

The Upper Freeport coal again decreases in thickness northward. On the top of the ridge in the vicinity of the road between Indiana and Greenville, the coal is 4 feet thick, including a 1 inch shale parting 9 inches from the bottom, and another 6 inches thick, 8 inches from the top. It is even thinner near Penn Run, and has two 3 inch shale partings. In the area directly north of Penn Run the Upper Freeport is thin and unimportant. On Dixon and Rayne Runs the coal is thin and in large areas is entirely lacking.

Recent drilling and studies made by competent engineers indicate that the Upper Freeport coal averages less than 18 inches thick in Northern Buffington, Pine, Eastern Cherryhill and Southern Green townships. The Upper Freeport is 18 inches thick at Nolo. At Pineton and Heilwood it ranges from 12 to 20 inches thick. It is 2 feet 5 inches thick at Mitchells Mills; 2 feet at Cookport; 4 feet 6 inches at Pleasant Valley, but carries a 12 inch bone parting near the top. The coal is thinner at Utah, and the parting is 10 inches thick.

The Upper Freeport coal is a persistent and very valuable bed in the northeastern townships, particularly in the Glen Campbell district. In Grant township, between East and Kairigh Runs the coal ranges from 3 feet to 3 feet 7 inches thick and has 4 to 6 inches of bone coal at the top. The coal is 5 feet thick near the western township line, southwest of Kinter Hill; 4 feet near Richmond and north of Kinter Hill. East of Mahoning Creek in Grant and Montgomery townships the coal ranges from 2 to 5 feet thick, locally has a thin bone parting near the bottom, and a few inches of bone at the top. The coal averages about 3 feet thick in Banks township. It has a characteristic parting 1 or 2 inches thick a few inches from the bottom, and invariably a few inches of bone coal at the top. It is 5 feet 8 inches thick at Rossiter, Canoe township, and has a 2 inch shale parting 6 inches from the bottom. South of Rossiter the coal thins to 4 feet, but is clean. At Juneau the coal varies in thickness and is rather dirty locally. A few miles south of Locust the coal is 4 feet 4 inches thick including 4 inches of bone coal at the top. Near Enterprise it is 3 feet 10 inches, not including 5 to 10 inches of bone coal at the top of the bed.

The composition of the Upper Freeport coal is as follows:

| | Per cent | |
|---------------------------|----------|----|
| Range | Average | |
| Volatile matter - - - - - | 24-34 | 28 |
| Fixed carbon - - - - - | 55-67 | 58 |
| Ash - - - - - | 6-11 | 9 |
| Sulphur - - - - - | 1-3.5 | 2 |

It is a stick and block coal, of brilliant lustre, friable, and crumbles in handling. It is an excellent steam coal, and when washed makes good coke.

Coal Beds in Conemaugh Formation.

The Conemaugh formation contains about five coals that average less than 12 inches thick, but locally have a maximum thickness of 3 feet. Little is known about these coals, and their correlation is .

indefinite. No attempt will be made to name them in this report.

Near Gaibleton there are two coals about 60 and 130 feet above the Upper Freeport. The lower one is 2 feet thick. The higher coal is 3 feet thick on Brush Run and on the hills west of Rayne Run.

On the headwaters of Crooked Creek between Onberg and Ideal, there are several openings in the Conemaugh formation on a coal bed above the Mahoning sandstone, and about 100 feet above the Upper Freeport. The coal is 2 feet 10 inches thick, including 4 inches of bone coal, 6 inches from the top.

On Brush Creek, $1\frac{1}{2}$ miles southwest of Mechanicsburg, a coal about 200 feet above the Upper Freeport has been opened, and is reported to be 3 feet thick.

A coal bed about 225 feet above the Upper Freeport is 3 feet thick near Kellers Mill, and appears to be rather persistent in a considerable area. The lower part of the bed is dirty, but the upper part is excellent, clean coal.

A coal at the Harlem horizon has been seen on Two Lick Creek. It is very irregular, has a maximum thickness of 28 inches, but is of excellent quality.

Coal Beds in Monongahela Formation.

Pittsburgh Coal. The northern most area of Pittsburgh coal in Pennsylvania is in the highland on the Armstrong-Indiana county-line south of Crooked Creek. The bed underlies $12\frac{1}{2}$ square miles in Indiana County. It ranges from 6 to 10 feet thick, including partings and roof coal. Generally the roof coal is so dirty that it is not mined, but used as a roof to hold up the soft shales above it. The bed is 7 feet 2 inches thick at West Lebanon, including a $\frac{1}{2}$ inch shale parting 2 feet 2 inches from the bottom, and 4 inches of bony coal, 2 feet 2 inches from the top. The coal is 9 feet thick at Iselin, including a 6 inch shale parting 2 feet from the bottom; on Big Run 8 feet thick, including 12 inches of shale 20 inches from the top; on Yiskiminitas River the bed is 6 feet 9 inches thick and carries a $1\frac{1}{2}$ inch shale parting 2 feet 5 inches above the bottom.

The Pittsburgh coal averages 56 per cent fixed carbon, 33 per cent volatile matter, 8 per cent ash, and 1.5 per cent sulphur. It is a hard stick and block coal, and mines out in fair sized lumps.

Redstone Coal. This bed, lying about 45 feet above the Pittsburgh bed, and composed of alternating bands of shale and coal, is very thin and irregular. It has a maximum thickness of 3 feet at Elders Ridge, but is too impure to be mined.

Sewickley Coal. This bed, lying 125 feet above the Pittsburgh, underlies a small area in the highest hills near Elders Ridge. It is 2 to 5 feet thick, but has not been mined because of its high ash and sulphur content.



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